DWR Home

Drought Preparedness Home

Did you know that..?

Frequently Asked Questions

Background - Drought in California

Hydrologic and Water Supply Conditions

Information for Private Well Owners

Governor's Proclamations of States of Emergency Related to Water Shortages

Water Conservation and Water Use Efficiency Links

Executive Office
Department of Water Resources

1416 Ninth Street
Sacramento, CA
95814

Mailing Address:
P.O. Box 942836
Sacramento, CA
94236-0001

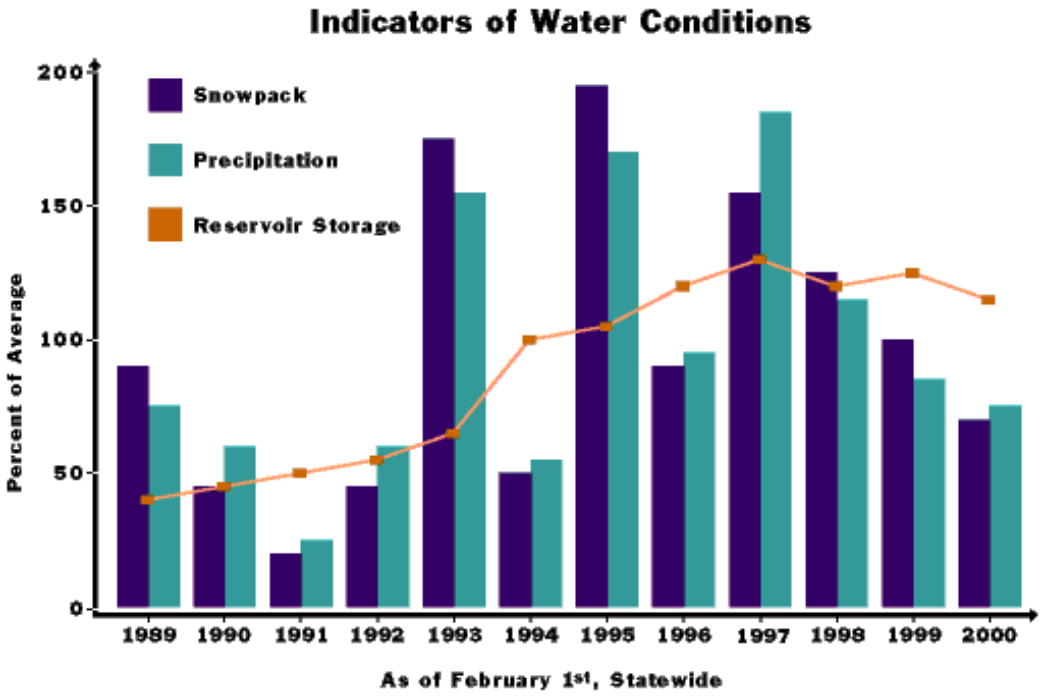
Search
DWR My CA

Background - Droughts in California

Defining Drought

One dry year does not normally constitute a drought in California, but serves as a reminder of the need to plan for droughts. California's extensive system of water supply infrastructure -- its reservoirs, groundwater basins, and inter-regional conveyance facilities -- mitigates the effect of short-term dry periods for most water users. Defining when a drought begins is a function of drought impacts to water users. Hydrologic conditions constituting a drought for water users in one location may not constitute a drought for water users elsewhere, or for water users having a different water supply. Individual water suppliers may use criteria such as rainfall/runoff, amount of water in storage, or expected supply from a water wholesaler to define their water supply conditions.

The graphic below illustrates several indicators commonly used to evaluate California water conditions. The percent of average values are determined for measurement sites and reservoirs in each of the State's ten major hydrologic regions. Snowpack is an important indicator of runoff from Sierra Nevada watersheds, the source of much of California's developed water supply.



Drought is a gradual phenomenon. Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts occur slowly, over a multiyear period. There is no universal definition of when a drought begins or ends. Impacts of drought are typically felt first by those most reliant on annual rainfall -- ranchers engaged in dryland grazing, rural residents relying on wells in low-yield rock formations, or small water systems lacking a reliable source. Criteria used to identify statewide drought conditions do not address these localized impacts. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline.

Past California Droughts

Droughts exceeding three years are relatively rare in Northern California, the source of much of the State's developed water supply. The 1929-34 drought established the criteria commonly used in designing storage capacity and yield of large Northern California reservoirs. The table below compares the 1929-34 drought in the Sacramento and San Joaquin Valleys to the 1976-77 and 1987-92

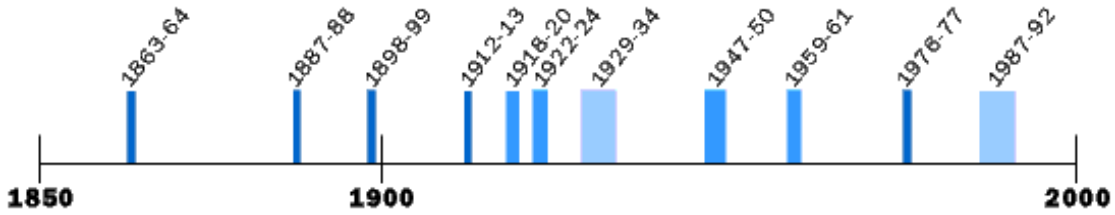
droughts. The driest single year of California's measured hydrologic record was 1977. California's most recent multi-year statewide drought was 1987-92.

Severity of Extreme Droughts in the Sacramento and San Joaquin Valleys

Drought Period	Sacramento Valley Runoff (maf/yr)	Sacramento Valley Runoff (% Average 1901-96)	San Joaquin Valley Runoff (maf/yr)	San Joaquin Valley Runoff (% Average 1906-96)
1929-34	9.8	55	3.3	57
1976-77	6.6	37	1.5	26
1987-92	10.0	56	2.8	47

Measured hydrologic data for droughts prior to 1900 are minimal. Multi-year dry periods in the second half of the 19th century can be qualitatively identified from the limited records available combined with historical accounts, as illustrated in the figure below, but the severity of the dry periods cannot be directly quantified.

California's Multi-Year Historical Dry Periods
1850-present



1. Dry periods prior to 1900 estimated from limited data.
2. Covers dry periods of statewide or major regional extent.

One approach to supplementing California's limited period of measured data is to statistically reconstruct data through the study of tree rings (called dendrochronology). Information on the thickness of annual growth rings can be used to infer the wetness of the season. Other site-specific approaches to supplementing the historical record can include age-dating dryland plant remains now submerged in place by rising water levels, or sediment and pollen studies.

The National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center has compiled a web site of existing hydroclimatic reconstructions (streamflow, precipitation, drought indices) for California based on tree-ring data. The site also shows locations of existing tree ring chronologies that could be used to generate additional reconstructions. Links are provided for similar information for the Colorado River Basin, an important source of water supply for Southern California.

Excavations for construction of Metropolitan Water District's Diamond Valley Lake in Riverside County yielded numerous paleontology resources, including partial remains of mastodons. The mastodons, together with other extinct species such as long-horned bison and ground sloths, occupied Diamond and Domenigoni Valleys during the Pleistocene Epoch, the time of the last Ice Age. The area's climate was then cooler and wetter than present. Photograph courtesy of MWD.

The Long-term Climatic Viewpoint

The historical record of California hydrology is brief in comparison to geologically modern climatic conditions. The following sampling of changes in climatic conditions over time helps put California's twentieth century droughts into perspective. Most of the dates shown below are necessarily approximations. Not only must the climatic conditions be inferred from indirect evidence, but the onset or extent of changed conditions may vary with geographic location. Readers interested in the subject of paleoclimatology are encouraged to seek out the extensive body of popular and scientific literature on this subject. An overview of the subject can be found on the web site for NOAA's paleoclimatology program.

PAST CALIFORNIA CLIMATIC CONDITIONS

circa 11,000 years before present	Beginning of Holocene Epoch- Recent time, the time since the end of the last major glacial epoch
6,000 years before present	Approximate time when trees were growing in areas now submerged by Lake Tahoe. Lake levels were lower then, suggesting a drier climate.
900-1400 A.D.(approximate)	The term "Medieval Megadrought" is used by some climate researchers to describe a series of long-duration droughts occurring in the Western United States during this time period. Physical evidence of these droughts remains not only in the tree-ring record, but also in relict tree stumps rooted in present-day lakes, rivers, and marshes in the Sierra Nevada – including Mono Lake, Tenaya Lake, Fallen Leaf Lake, West Walker River, and Osgood Swamp. Researchers identified two epic drought periods from these remains, one lasting more than two centuries prior to A.D. 1112, and the other lasting more than 140 years prior to 1350. Recent tree-ring-based streamflow reconstructions (see figure) funded by the Department confirm similarly epic drought periods in the Colorado River Basin in these timeframes. These drought conditions in the Four Corners region of the Southwest are considered to be one reason for the decline and eventual disappearance of the complex Anasazi cultures that had relied on irrigated agriculture to support relatively high-density populations.

1300-1800 A.D. (approximate)	The Little Ice Age, a time of colder average temperatures. Norse colonies in Greenland failed near the start of the time period, as conditions became too cold to support agriculture and livestock grazing.
Mid - 1500s A.D.	Sustained drought throughout much of the continental U.S., lasting as long as 50 years according to tree-ring records. Drought suggested as a contributing factor in the failure of European colonies at Parris Island, South Carolina and Roanoke Island, North Carolina.
1850s A.D.	Sporadic measurements of California precipitation began.
1890s A.D.	Long-term streamflow measurements began at a few California locations

For an Introduction to Paleoclimatology:

http://www.ngdc.noaa.gov/paleo/perspectives.html

Back to Top of Page